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Survey and surveillance of pollinators in mango ecosystem

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ABSTRACT: A total 13 insect species were observed visiting on mango flowers and maximum population of floral visitors belonged to order Diptera (Blow flies, *Chrysomya megacephala* Fab.; Syrphid flies, *Syrphus* sp., *Eristalinus arvorum* Fab. and house fly, *Musca domestica*) followed by Hymenopteran bees (*Apis florea* Fab.; *Apis cerana indica* Fab.; *Apis mellifera* L.; *Apis dorsata* Fab. and *Tetragonula iridipennis* Smith), Wasp, *Vespula orientalis* L.; and Red ant, *Oecophylla smaragdina* (Fab.). Maximum intensity of pollinators or visitors was observed during full bloom stage of the crop and highest activity was recorded on the middle portion of the tree canopy (2.05 pollinators or visitors/panicle/5 minutes) followed by lower and top portion of the tree canopy. Whereas, maximum pollinators or visitors was recorded on south direction (2.17 /panicle) followed by north, west and east direction.

Keywords: Blow flies, Diptera, Hymenoptera, Insect, Mango, Pollinators, Syrphus, Visitors

INTRODUCTION

Mango (*Mangifera indica* L.), considered important fruit crop in tropical and sub-tropical regions of India. Among Indian states, Gujarat covers 150 thousands hectare area with total 1.24 million tonnes of production and 8.10 tonnes/ha productivity (Anonymous, 2015-16). It is highly cross-pollinated crop and requires various external agencies for pollination (Singh 1954, Badiyala and Garg 1990 and Bhatia *et al,* 1995). Among them, insect pollinations are essential for pollination (Deodikar and Suryanarayana, 1977 and Shinde *et al*, 2001). No fruit set was obtained when the panicles were bagged reported by Bhatia *et al,* 1995, Shinde *et al*, 2001 and Kumari *et al,* 2014. Considering the significance of insect pollinators or visitors for the improved qualitative and quantitative production of mango, this study was conducted to observe the diversity and relative abundance of pollinators or visitors in south Gujarat mango ecosystem.

MATERIALS AND METHODS

The present studies were carried out at ICAR-All India Coordinated Research Project on fruits centre, Agriculture Experimental Station, Navsari Agricultural University, Paria (20°26'N, 72°58'E) during 2007-08 to 2018-19. Systematic roving surveys were carried out in the mango orchards at flowering stage to observe the diversity of insect pollinator's/visitors and weekly observations of insect pollinators or visitors were recorded in the mango orchard cv. Alphonso (10 x 10 m) on 10 panicles per tree from randomly selected trees at different direction (north, east, west and south direction) and different canopy portion of the tree (top, middle and lower). Experimental trees were kept free from any pesticide application during the study periods. The figures in the article were drawn using Microsoft Office Excel.

RESULTS AND DISCUSSION

A total of 13 insect species were observed visiting on mango flowers belonging to four species of the order Diptera, seven species of Hymenoptera, one species of Lepidoptera and Odonata. Among them, dipterans insects were the dominant on mango flowers. The Hymenopterans were the second major group of insects found visiting on mango flowers. The samples of different pollinators/visitors were collected, preserved and identified (Table 1). Usha *et al.* (2014) reported that 20 insect species were observed visiting on mango during blooming periods at Pantnagar climatic conditions. Among them dipterans, syrphids were observed the most frequent visitors (44.67%) followed by hymenopterans bees (40.95%). The primary pollinators were stingless bees (*Trigona biroi*), calliphorids (*Chrysomya* sp.), syrphids (*Eristalis* sp.) and honeybees (*Apis cerana* and *A. mellifera*) reported on mango flowers by Fajardo *et al.* (2008). Pollinators of mango are honey bees (*Apis dorsata, A. florae, A. cerana indica*), stingless bees (*Trigona* sp*, Melipones* sp.) housefly (*Musca nebulo*) reported at Sangareddy, Andhra Pradesh by (Kumari *et al,* 2014).

Abundance and peak activity of insect pollinators: There are about thirteen species of insect visitors/ pollinators were observed on mango flowers. Of these, dipterans flies and honey bees were recorded as major

Table 1. Diversity of the insect visitors or pollinators on flowers in south Gujarat mango ecosystem

S. No.	Common name	Scientific Name	Order: Family
1	Little honey bee	*Apis florea* Fab.	Hymenoptera : Apidae
2	Indian honey bee	*Apis cerana indica* Fab.	Hymenoptera : Apidae
3	European honey bee	*Apis mellifera* L.	Hymenoptera : Apidae
4	Giant honey bee	*Apis dorsata* Fab.	Hymenoptera : Apidae
5	Stingless bee	*Tetragonula iridipennis* Smith	Hymenoptera : Apidae
6	Blow flies	*Chrysomya megacephala* Fab.	Diptera : Calliphoridae
7	Syrphid fly	*Syrphus* sp.	Diptera : Syrphidae
8	Syrphid fly	*Eristalinus arvorum* Fab.	Diptera : Syrphidae
9	Housefly	*Musca domestica* L.	Diptera : Muscidae
10	Wasp	*Vespula orientalis* L.	Hymenoptera : Vespidae
11	Red Ant	*Oecophylla smaragdina*	Hymenoptera : Formicidae
12	Dragon fly	Unidentified sp.	Odonata
13	Butterfly	Unidentified sp.	Lepidoptera

pollinators or visitors on mango flowering periods. Pollinators or visitors activity was observed from 52-13th SMW with more or less trends during twelve years consecutive study periods (Fig. 1). In 2007-08, intensity of pollinators/visitors ranged from 0.48 to 2.59 /panicle/5 minutes. The maximum was observed on 1st SMW (2.59 pollinators or visitors/panicle/5 minutes) followed by 4th SMW (2.51/panicle) and 3rd SMW (2.42/panicle), respectively. Subsequently, flowering initiation was started late comparing with preceding and succeeding years (7th SMW) with ranged from 1.05 to 1.55 pollinators or visitors/panicle/5 minutes. During 2009-10, maximum pollinators or visitors population was recorded 4th SMW (2.29 /panicle) followed by 5th and 3rd SMW in the order of 2.19 and 2.13 pollinators or visitors/panicle/5 minutes. Afterwards, pollinators activity started 52-11th SMW with ranged from 1.41 to 2.48/panicle while maximum was counted on 5th SMW. Pollinators or visitors activity was counted from 2-12th SMW and peak was observed on 7th SMW (2.34 and 2.52/panicle) during next two years. During 2013-14, activity of pollinators or visitors was observed 52-9th SMW with highest was counted on 4th SMW (3.0/panicle) followed by 5th SMW (2.70/ panicle). In the next year, activity was observed on 3-10th SMW. Maximum population was observed on 7th SMW (2.97/panicle) followed by 8th (2.48/panicle) and 6th SMW (1.91/panicle), respectively. Highest number of pollinators (3.16/panicle/5 minutes) was recorded during 6th SMW (second week of February) coinciding with peak flowering during 2015-16. Consequently, pollinators' activity was recorded from the initiation of flowering. Maximum number of pollinators was observed during 7th SMW with 1.82 pollinators/panicle/5 minutes. The insect pollinators observed from 1-9th SMW of the year 2017-18 when the maximum trees remain in flowering stage. During 2018-19, activity of pollinators was started in the second week of January with initiation of flowering (Fig. 1). The maximum number (1.94/panicle/5 minutes) of pollinators were recorded 7th SMW followed by 6th SMW (1.41/panicle).

Maximum average abundance of pollinators or visitors was recorded during 2013-14 flowering periods (2.10 pollinators or visitors/panicle/5 minutes) followed by 2012-13 (2.0/panicle). However, maximum peak activity of pollinators was observed in 6th SMW (3.16 panicle/5 minutes followed by 4th SMW (3.0 pollinators/5 minutes) and 7th SMW (2.97 pollinators/5 minutes), respectively at full bloom stage of the crop (Table 2 and Fig. 1). Based on the pooled results, activity of pollinators or visitors was started at initiation of flowering (end of December) and maximum number of pollinators was counted in 7th SMW with 2.10 /panicle/5 minutes followed by 6th SMW (1.83 /panicle) and 8th SMW (1.62 /panicle), respectively at full bloom stage of the crop during the study periods (Fig. 2). Thereafter, foraging activities of the pollinators or visitors synchronized with flowering periods. Kumari *et al.* (2014) reported that maximum population of pollinators was recorded on 5th SMW and thereafter pollinator started declined gradually in Sangareddy, Andhra Pradesh agro-climatic conditions. Reddy *et al*. (2012) documented diversity of mango pollinators in Bengaluru and found little bee , *Apis florea* and dipteran, *Chrysomya megacephala* as major pollinators of mango.

Table 2. Abundance of pollinators or visitors on mango flowers during the study periods

Parameters	Pollinators or visitors/panicle/5 minutes											
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Average population	1.71	1.33	1.80	1.93	1.78	2.00	2.10	1.39	1.39	0.66	0.68	0.72
Peak population	2.59	1.55	2.29	2.48	2.34	2.52	3.00	2.97	3.16	1.82	1.47	1.94
Peak period of activity (SW)	1	12	4	5	7	7	4	7	6	7	5	6

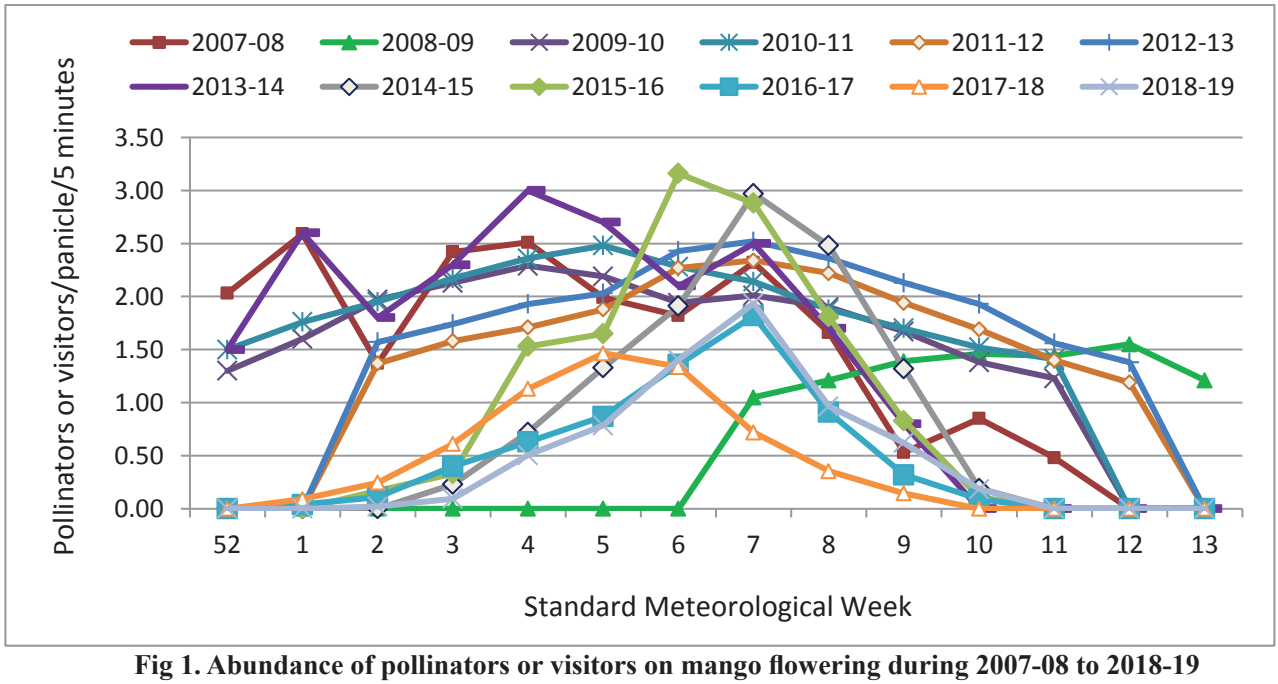

Fig 1. Abundance of pollinators or visitors on mango flowering during 2007-08 to 2018-19

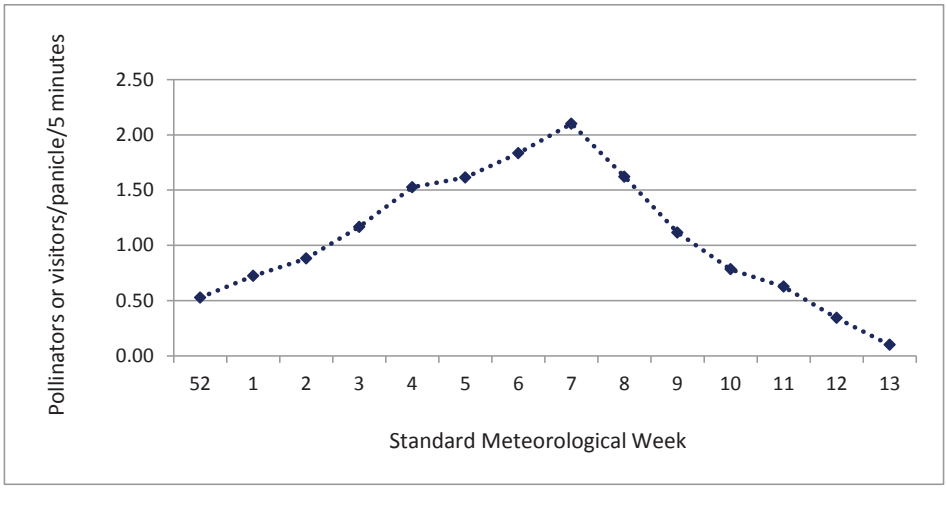

Fig 2. Abundance of pollinators or visitors on mango flowering during the study periods (Pooled)

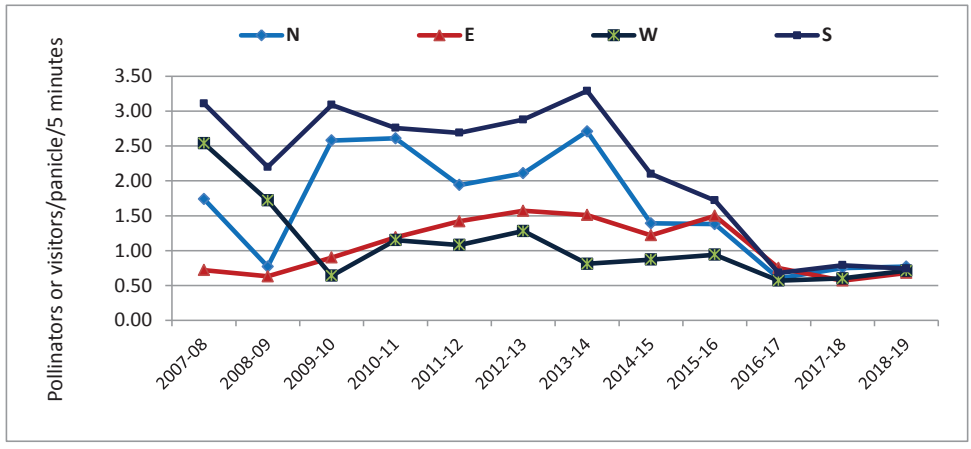

Fig 3. Pollinators or visitors activity on different direction of the tree during the study periods

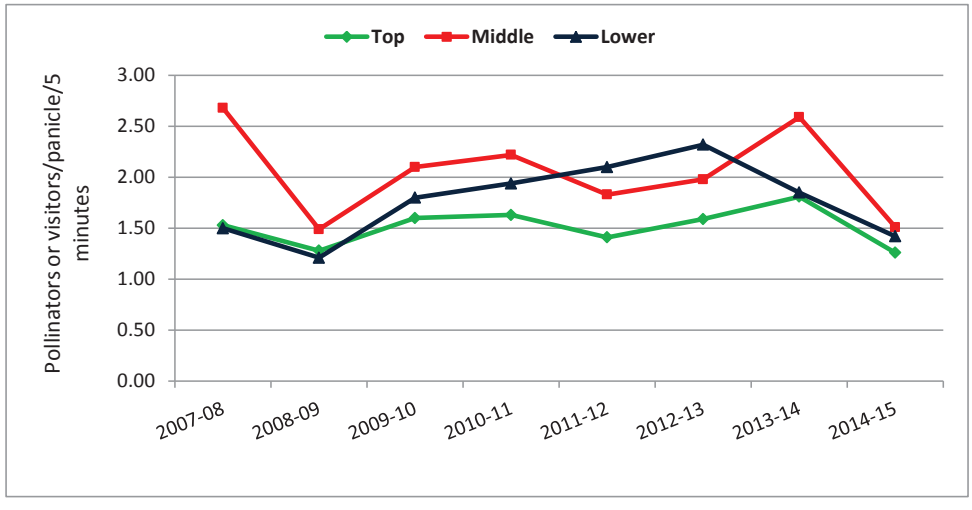

Fig 4. Pollinators or visitors activity on different portion of the tree canopy during the study periods

With respect to their spatial distribution, activity on canopy wise maximum intensity of pollinators or visitors was recorded on middle portion of the tree canopy (2.05/ panicle/5 minutes) followed by lower (1.77/panicle) and top position (1.51/panicle) (Fig.3). On the other hand, maximum activity of pollinator or visitors was recorded in South direction (2.17 pollinators or visitors/panicle/5 minutes) followed by North (1.61/panicle), West (1.08/ panicle) and East direction (1.06/panicle) (Fig. 4). Kumari *et al,* 2014 support the present findings and reported that maximum number of pollinators was observed in the medium portion of the tree canopy and highest activity was recorded in the north direction followed by east and west direction. Activity of bees reported in all direction of the tree canopy however, more in the east direction reported by Verghese (1997).

In conclusions, this study clarifies that what kinds of pollinators or visitors on mango flowers in south Gujarat ecosystem. On the basis of results it may be concluded that 13 insect species were observed visiting on mango flowers. Dipterans constituted major group of pollinators followed by Hymenopterans. Maximum pollinators was observed in 7th SW (2.10 pollinators/panicle/5 minutes) followed by 6th SW (1.83 pollinators/panicle/5 minutes) at full bloom stage of the crop and maximum intensity of pollinators or visitors was recorded on middle portion of the tree canopy (2.05/panicle/5 minutes) followed by lower and top position. On other hand, maximum activity was recorded in south direction (2.17/panicle/5 minutes) followed by north, west and east direction.

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REFERENCES

Anonymous. 2015. National Horticulture Board. www.nhb.com.

Badiyala, S.D. and Garg, R. 1990. Studies on the pollination and fruit production by *Apis mellifera* L. in seven cultivars of litchi (*Lithi chinensis* Sonn.). *Indian Bee Journal,* **52**: 28-30.

Bhatia Ranjeet, Gupta Divender, Chandel, J.S. and Sharma, N. K. 1995. Relative abundance of insect visitors on flowers of major subtropical fruits in Himachal Pradesh and their effect on fruit set. *Indian Journal of Agricultural Sciences,* **65** (12): 907-12.

Deodikar, G. B. and Suryanarayana, M. C. 1977. Pollination in the services of increasing farm production in India. *Advances in pollen-spore Research,* **II**: 1-23.

Fajardo Alejandro. C., Jr, Medina Jose R., Opina Oscar .S. and Cervancia Cleofas . R. 2008. Insect pollinators and floral visitors of mango (*Mangifera indica* L. cv. Carabao). *The Philippine Agricultural Scientist,* **91** (4): 372-382.

Kumari, Anitha D, Madhavi Jyothirmayee, Bhagwan A and Raj Kumar M. 2014. Surveillance of pollinators and their behaviour in mango flower. *Plant Archives,* **14**: 727-729.

Reddy, P. V. R., Verghese, A., Varun Rajan, V., Rashmi T. and Kavitha, T. 2012. Diversity and foraging ecology of pollinators in mango (*Mangifera indica*): An Indian perspective. International Congress of Entomology, Daegue, South Korea 19-24 August 2012.

Shinde, A K., Waghmare, G. M. and Patil, B. P. 2001. Exploring pollinizers for enhancing productivity in Alphonso mango (*Mangifera indica*). *Indian Journal of Agricultural Sciences,* **71** (9): 592-594.

Singh, R. N. 1954. Studies on floral biology and subsequent production of fruits in the mango (*Mangifera indica* L.) varieties Dushehari and Langra. *Indian Journal of Horticulture,* **11**: 69-88.

Usha., Srivastava Poonam. and Goswami Vimla. 2014. Diversity of floral insect visitors of mango during blooming periods at Pantnagar. *Indian Journal of Agricultural Sciences,* **84** (3): 363-4.

Verghese, A. 1997. Impact of Apiculture in Horticulture. In: National Conference on Apiculture, Bangalore, India, p.38.

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